



BRINGING THE WORLD TOGETHER

DIVERS DEPLOYMENT CHALLENGES

Gigabit in the MDU

Greg Luhman, Business Development Manager

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An aerial photograph of a city at dusk. The sky is a mix of purple, blue, and orange. The city is densely packed with buildings, many of which are lit up. A prominent feature is a multi-lane highway or expressway that runs diagonally across the frame, with its lanes and surrounding areas illuminated. The overall scene conveys a sense of a busy, modern urban environment.

Why is this market important?

MDU Market

- MDUs represent 35% of the total residential market
 - 80 million households
 - 20 million apartments
- Growing demand driven by low vacancy rates
 - 306K new multi-family units added in 2015 (*Freddie Mac Report, 2016*)
- 45% of living units churn every 12 months
- More than 50% of MDU inhabitants are 30 years of age or younger



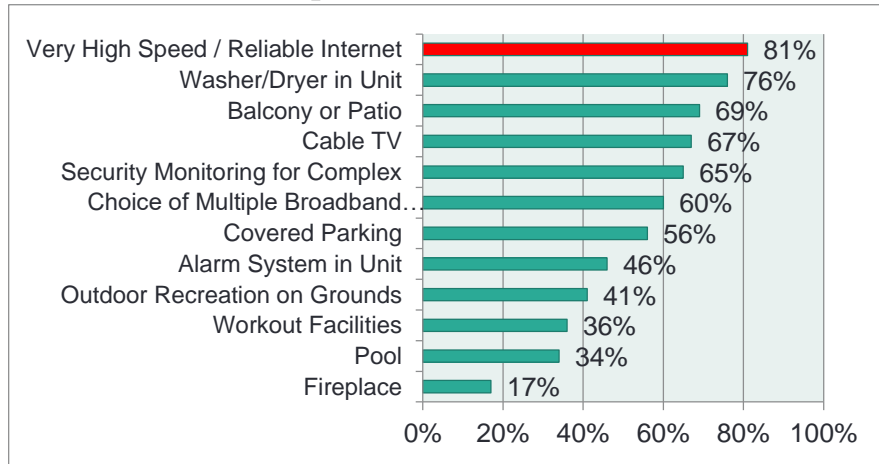
Millennials and MDUs

- Largest demographic in the US
- Growing spending power
 - \$1.4T by 2020
- Digital Natives – Constantly Connected
 - 80% smartphones
 - 75% on social media
 - 44% download music/videos
 - 50% are gamers
- The Renter Generation
 - Growing percentage prefer to rent vs. buy

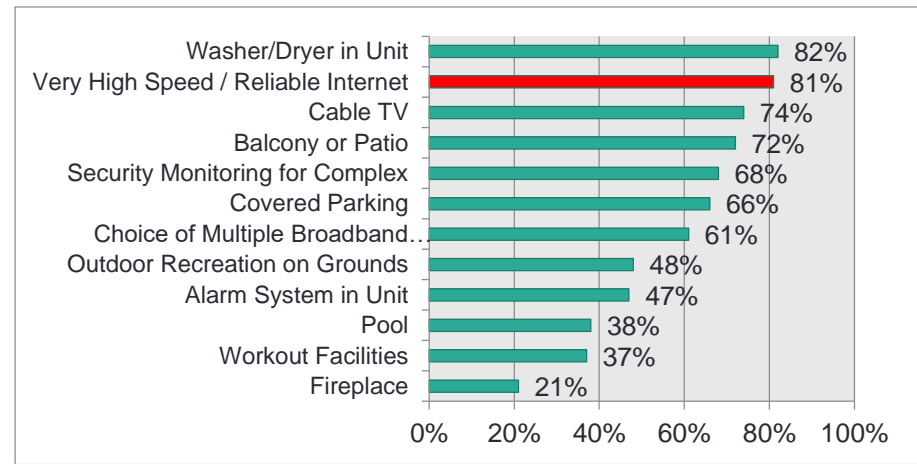


What Do Residents Want?

Apartments



Condominiums



Source: FTTH Council Study on MDUs, 2016

Broadband Demand is Growing

MDU owner's care mostly about...

NO VACANCY

Occupancy



Property Values



Rental Rates



Operational Costs

How does broadband impact the owner's top concerns?

Gigabit and MDU Home Values



+2.8%

Additional
\$8500 / \$300,000



+8%

Additional rent
up to \$1000/yr

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ACCESS CHALLENGES

MDU Market Challenges

- Owners & Access
 - Owners control access
 - Owners and Providers need to have common goals
 - Service Levels
 - Tolerance for Disruption
- High Turnover
 - Over 45% turnover every year
 - Average cost per lease between \$350 - \$425



Challenging nature drives a tool kit solution approach

Universal Service Levels?

17 x SFU
56 x MDU

Gigabit
FTTH

25Mbps
DSL

25Mbps
DSL

Gigabit
FTTH

Gigabit
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Fixed Wireless



Fiber

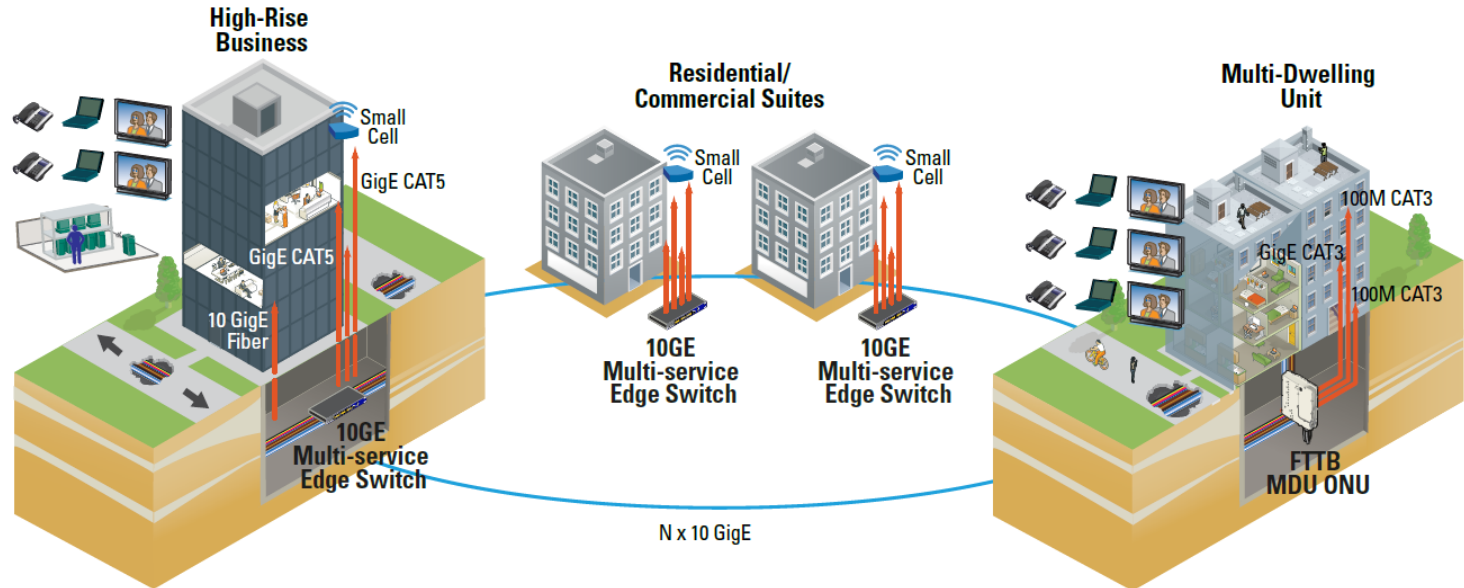
Copper

Connectivity

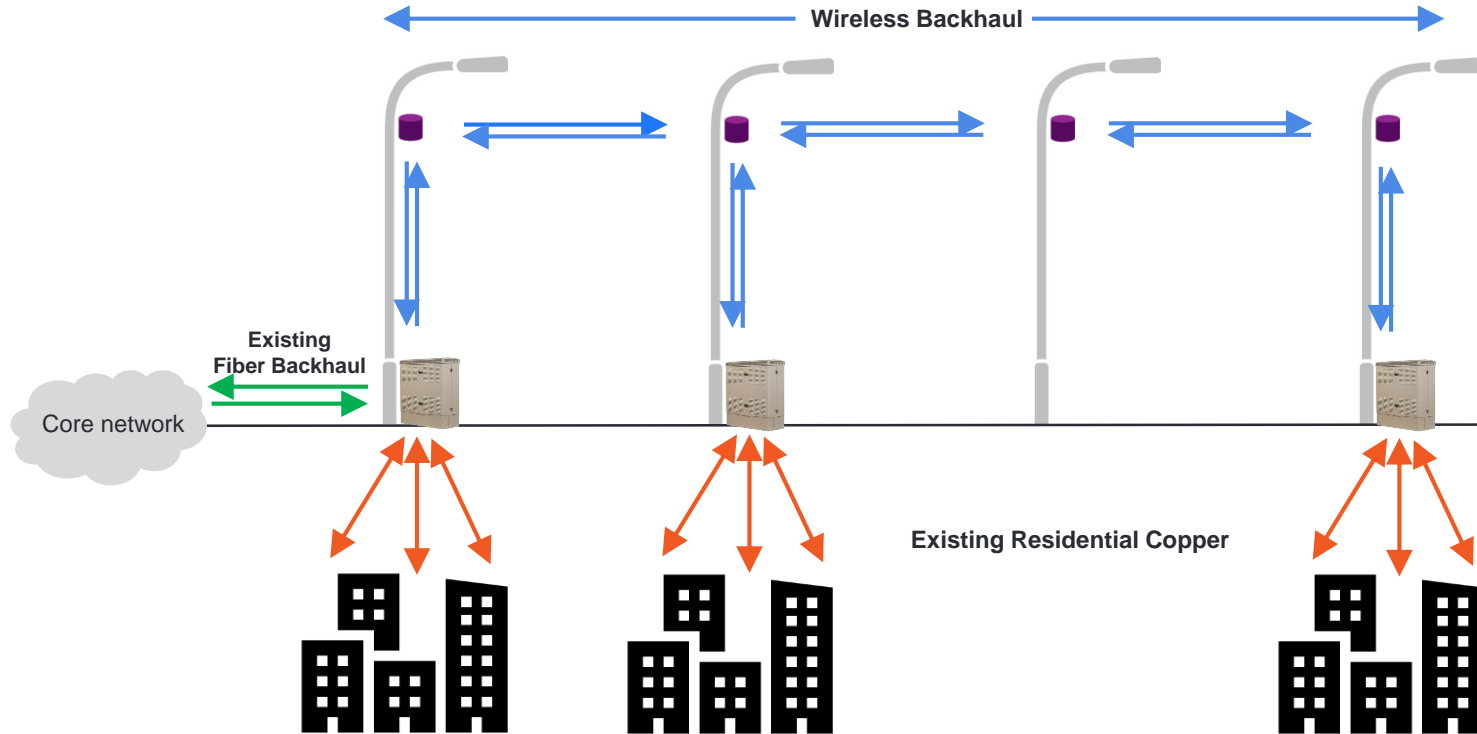
- On Net
- In Service
- What to use?

Fiber Connect

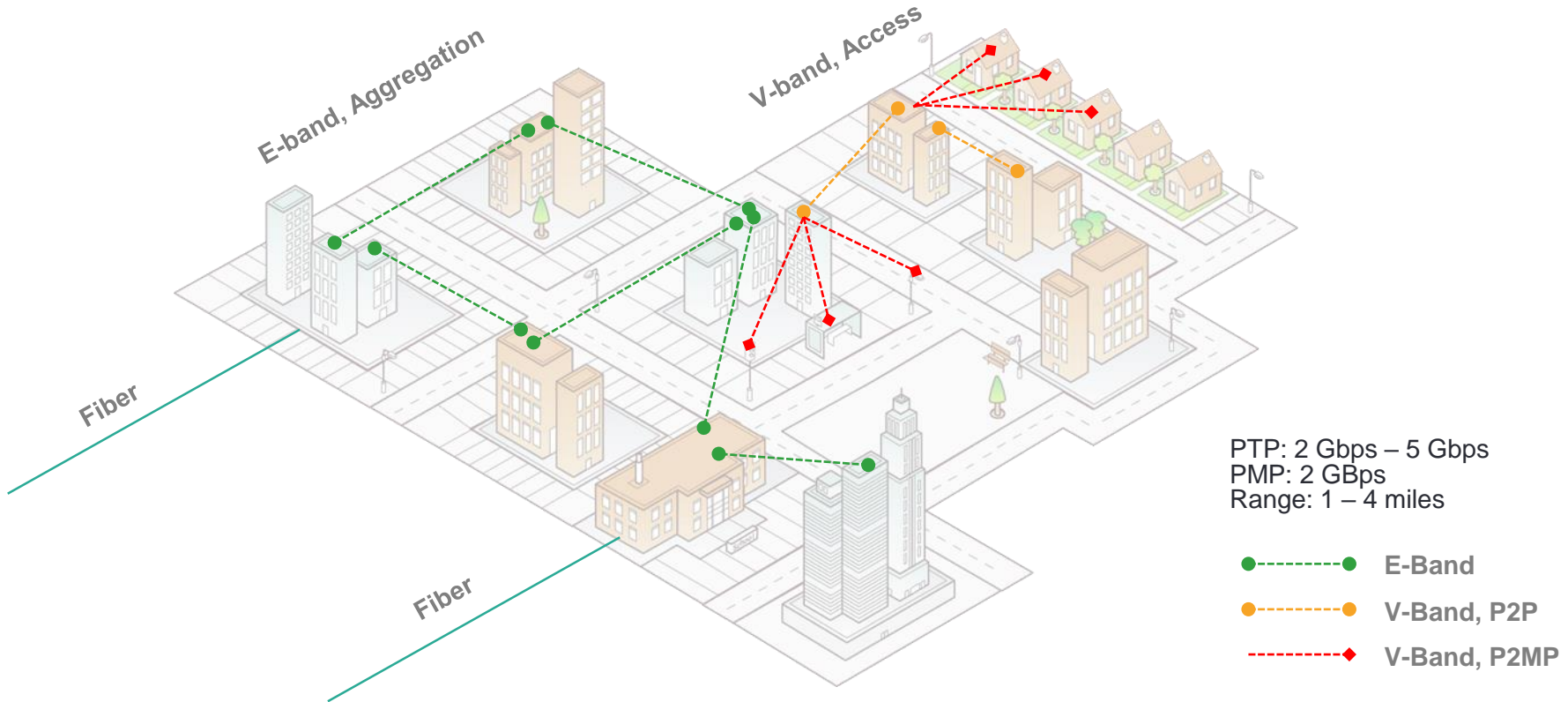
- Highest Bandwidth
- Highest construction effort



Line of Sight Wireless Backhaul



Hybrid Fiber Wireless

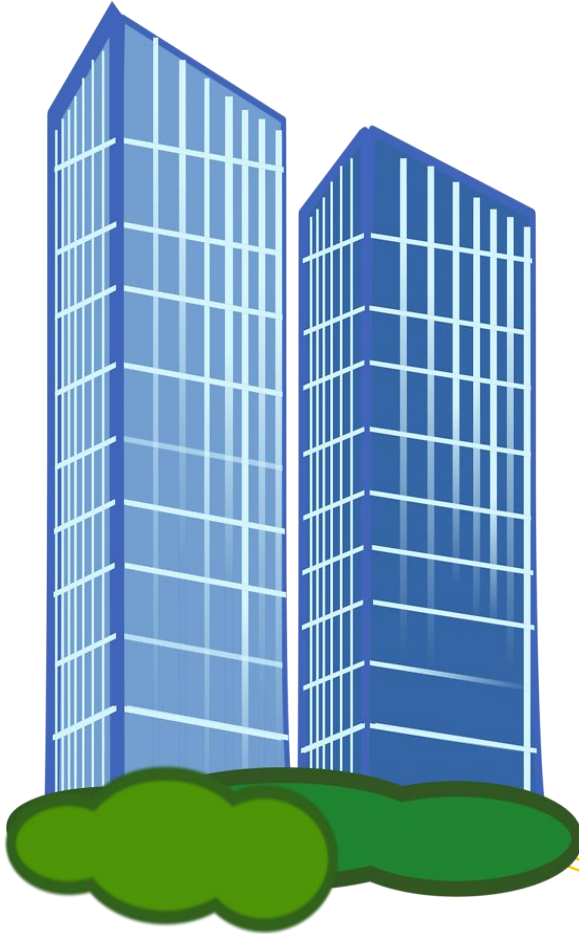


Legacy Copper Bonding

- Leverage Existing copper
- Lower speeds
- Lower Effort
- Wide Selection
 - Reach
 - Speeds
 - Technologies

4 to 48 Pairs

10 to 400Meg



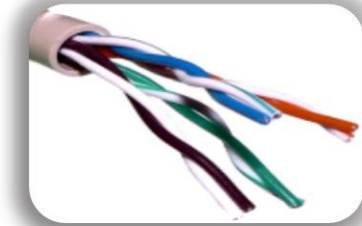
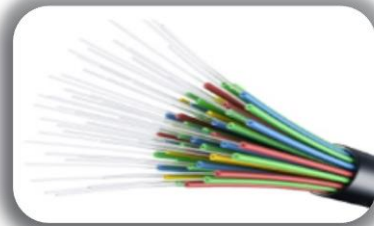
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SOLUTIONS

What's in the Gigabit Toolkit?

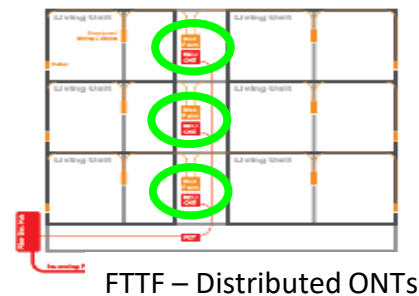
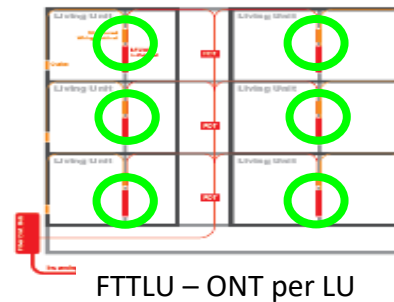


	GPON	NG-PON2	G.fast	10G EPON	DOCSIS 3.1
Deployment Model	FTTLU	FTTLU	FTTB/F	FTTLU	Fiber Deep
Physical Medium	Fiber	Fiber	Copper, Coax	Coax/Fiber	Coax
Downstream Rates	2.5 Gbps	40 Gbps	Up to 1 Gbps*	10 Gbps	10 Gbps
Upstream rates	1.25 Gbps	40 Gbps	Up to 1 Gbps*	10 Gbps	2 Gbps

* Throughput rates assume DTA and coax medium

MDU FTTH Architectures

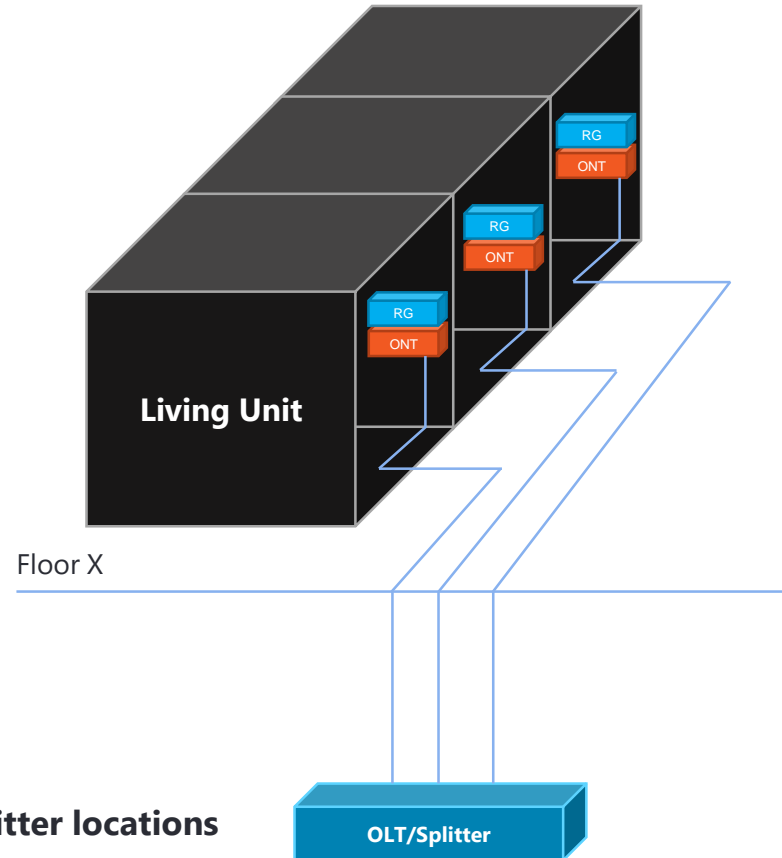
- **Fiber to the Living Unit (FTTLU)**
 - High-cost solution
- **Fiber to the Floor (FTTF)**
 - Medium-cost solution
- **Fiber to the Building (FTTB)**
 - Low-cost solution



COST, COMPLEXITY and FUNCTION

Fiber to the Living Unit

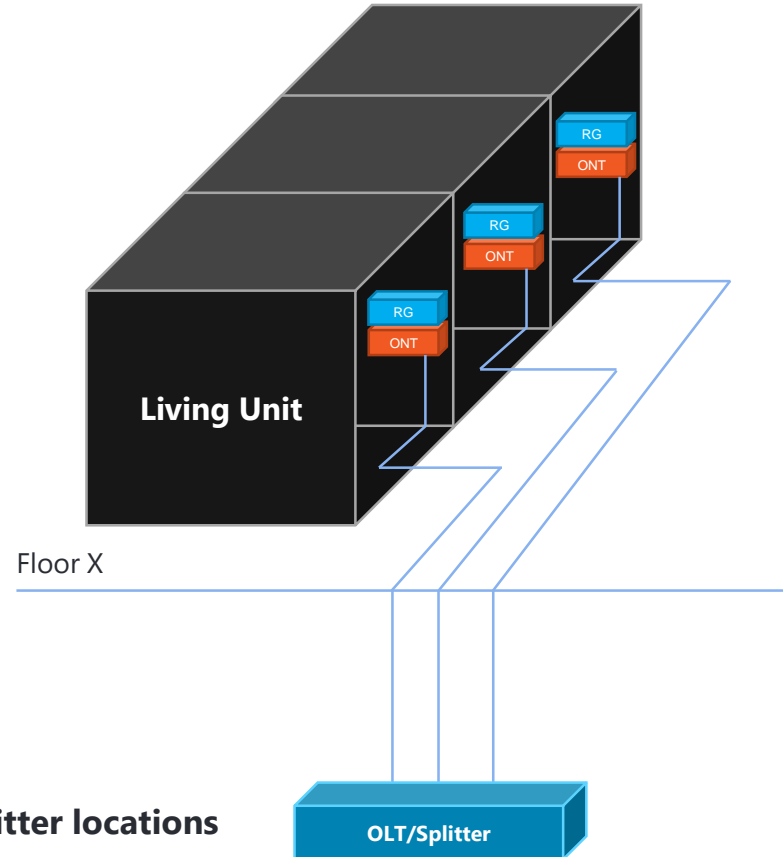
- **Fiber to the Living Unit (FTTLU)**
 - Pull Fiber Up the Riser
 - Pull Fiber to the Unit
 - ONT and power placed in each apartment
 - Completely future proof the building
 - Best chance for ubiquitous service across SFU and MDU footprint
 - High-cost solution



Multiple Options for OLT and Splitter locations

Fiber to the floor

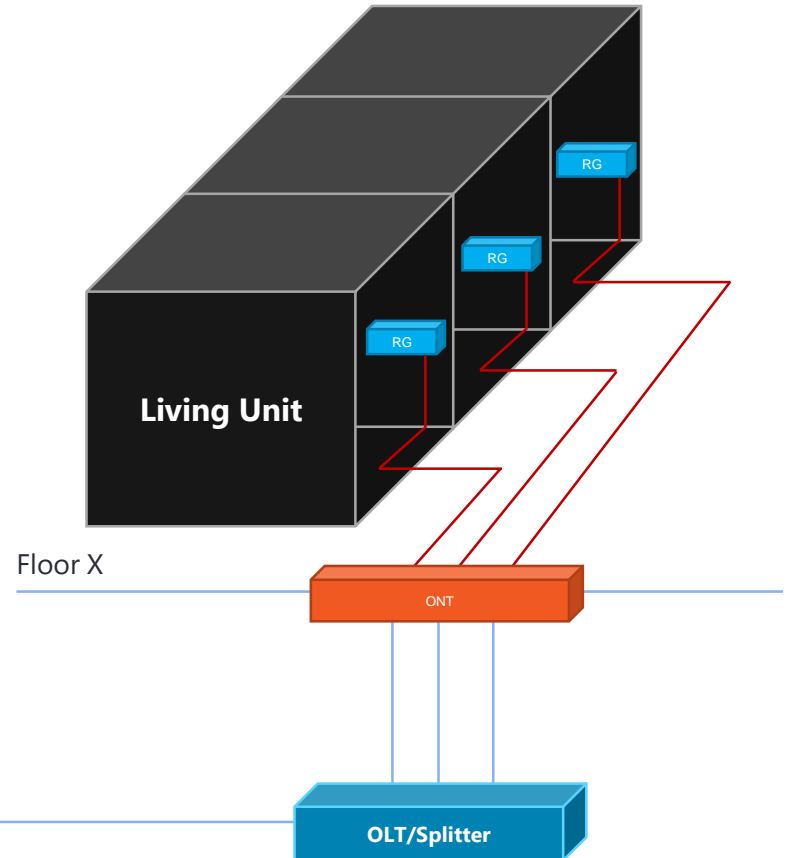
- **Fiber to the Floor (FTTF)**
 - ONTs and power placed on each floor
 - CAT-3 or CAT-5 based
 - Each port on ONT used for a unit
 - RG Required in each unit
 - Medium-cost solution



Multiple Options for OLT and Splitter locations

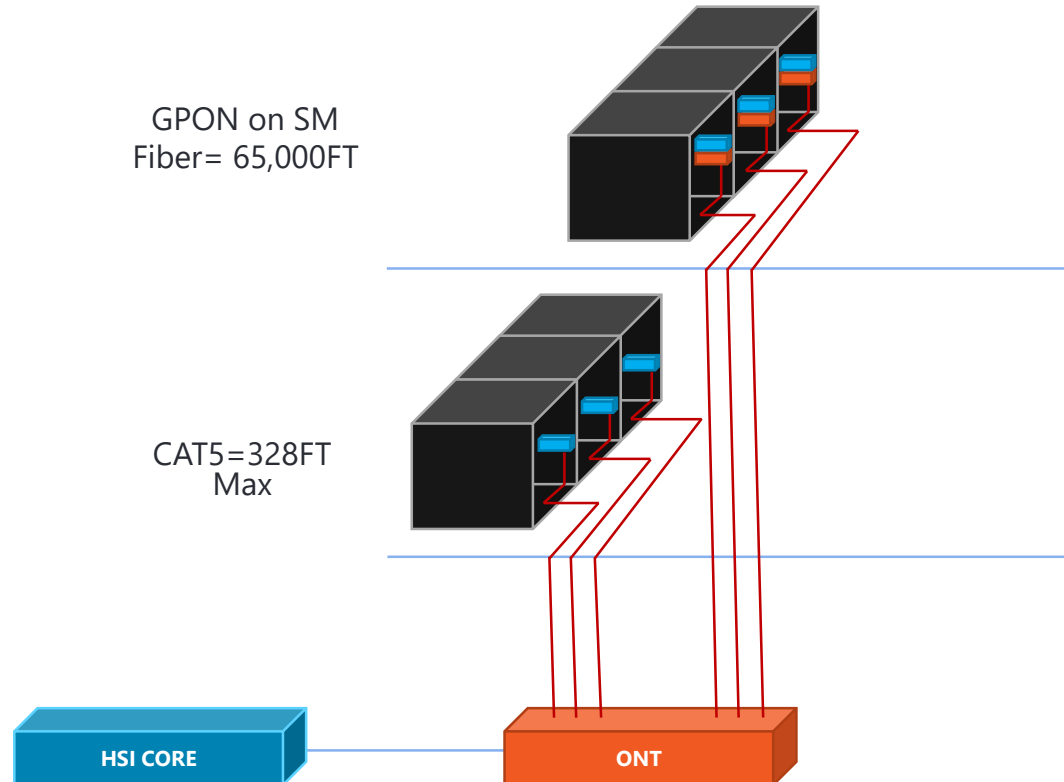
Fiber to the Building

- **Fiber to the Building (FTTB)**
 - ONTs and power placed in single location
 - CAT-3 or CAT-5 run to each apartment
 - Each port on ONT used for a unit
 - Low-cost solution



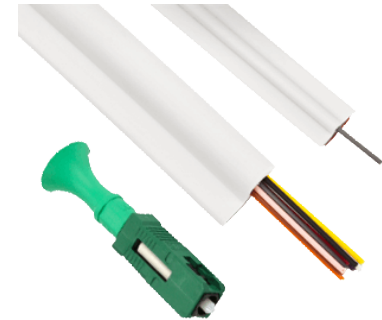
Distance Considerations

- Speed vs Distance
 - Technology Impact
- Cat 5 Limits
 - 328ft for Gigabit
 - Is the installed network able to support it?
- Cat 3 Limits
 - 10 or 100Megs
 - At Best
- Voice Grade
 - Move to xDSL or GFAST



Fiber in the Building

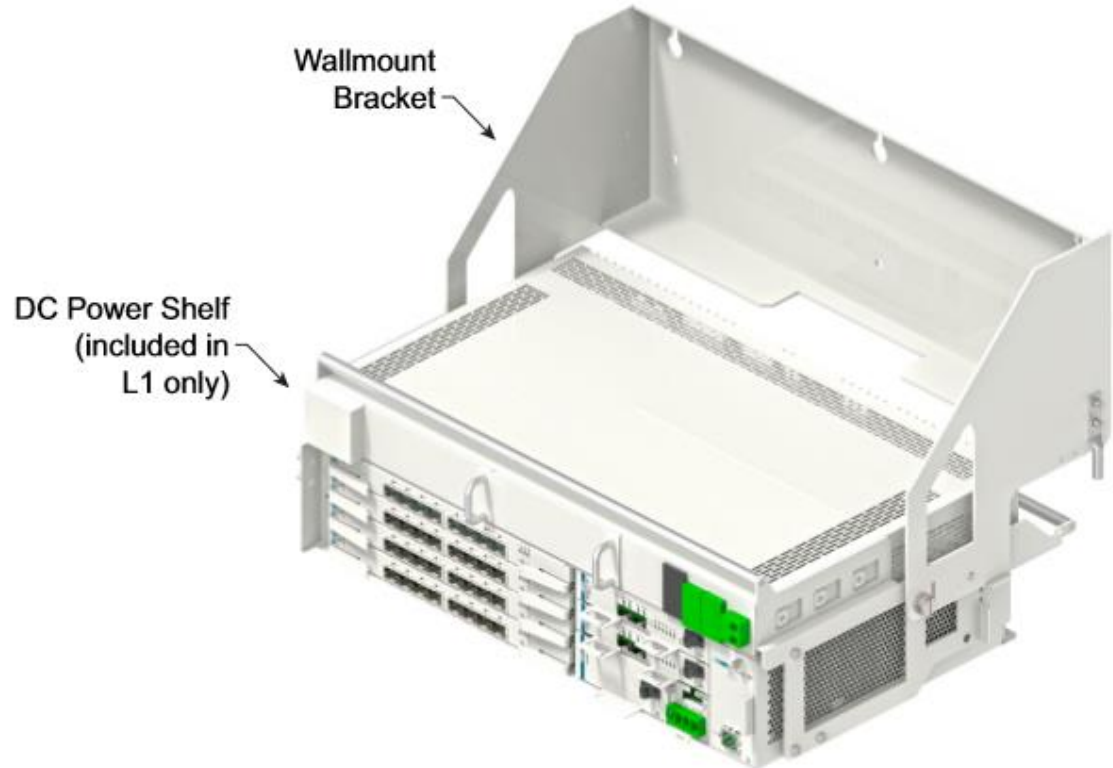
- Purpose built Fiber Distribution systems
- Faster Mechanical Splicing
- Mechanical Connectors
- Adhesive Duct Fiber
 - Stick it to the wall
- Wall plates and Outlet
 - Fiber based
- Bend Insensitive Fiber
 - Constructed for MDU deployment



Telecom Rooms

Welcome the Jungle

- Protect your Gear
 - Active and Passive
- Rack or Wall Space
- Access and Security
- **DC Power**



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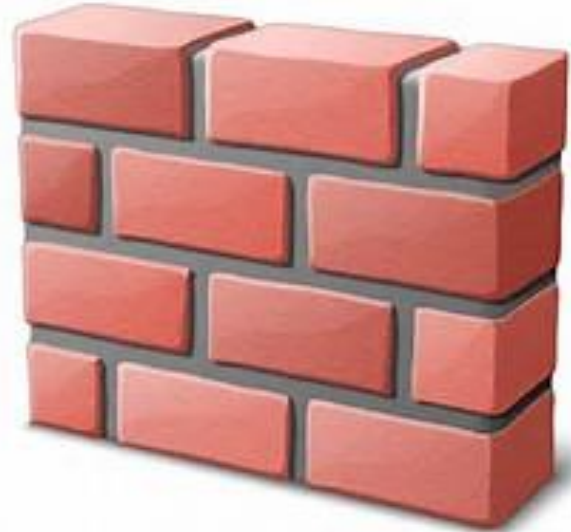
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LEVERAGING GFAST

Building Challenges

- Roadblocks
 - Historical
 - Aesthetics
- Access
 - Walls get in the way
 - Current plant condition
- Budgets
 - Labor cost
 - Cost of materials
- Competition
 - What will the market bear
 - Demographics of the building



**Which Brick wall
will you Encounter**

Universal Service Levels?

17 x SFU
56 x MDU

Gigabit
FTTH

25Mbps
DSL

25Mbps
DSL

Gigabit
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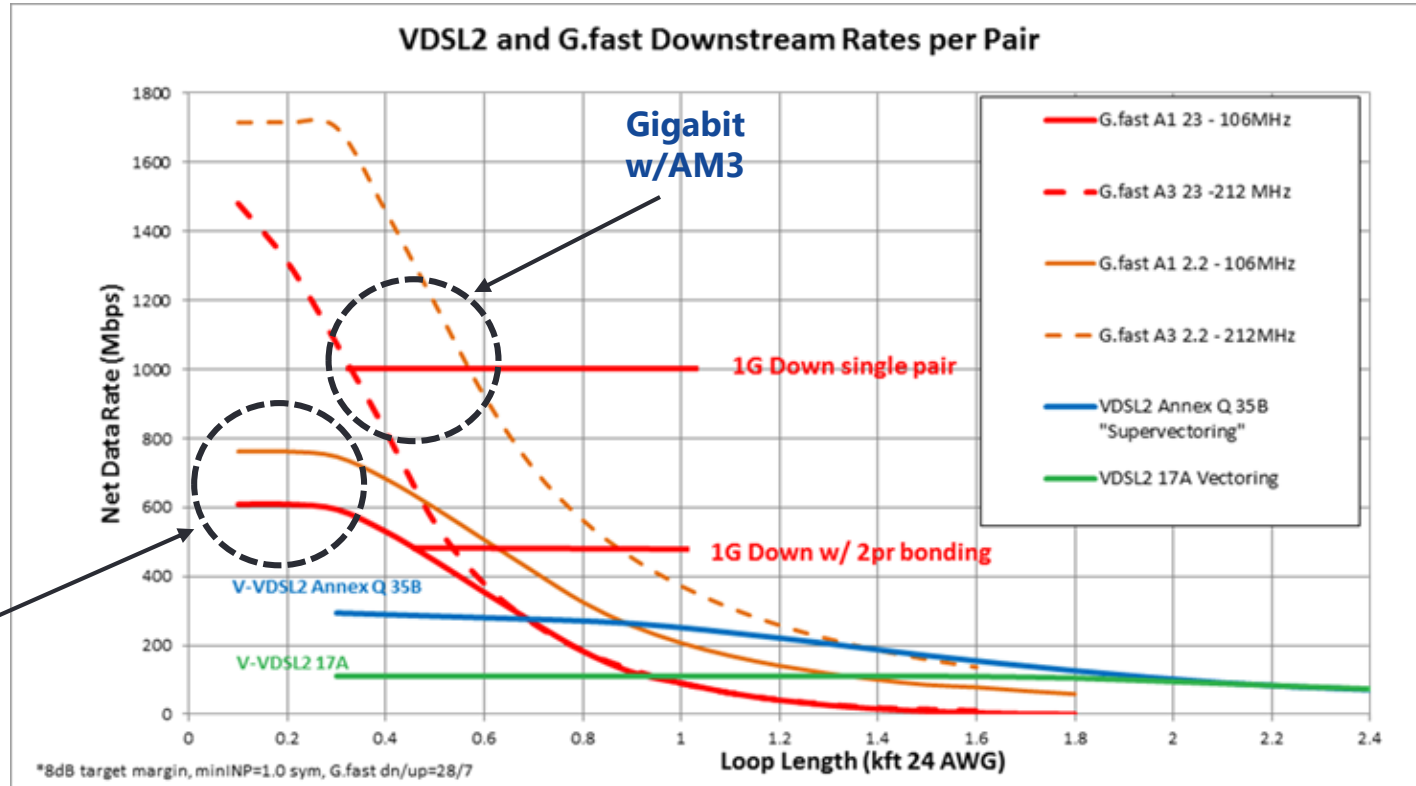
Gigabit
FTTH

Gigabit

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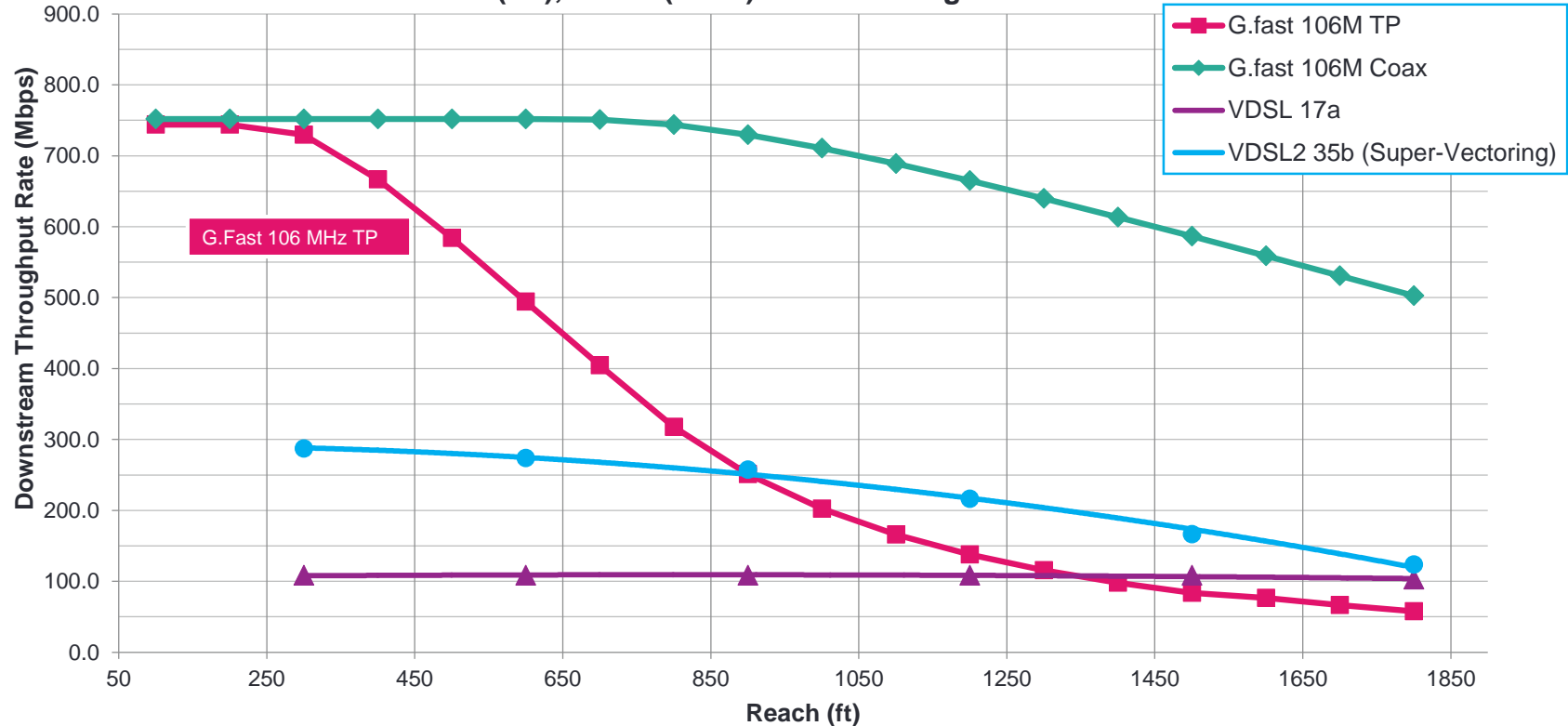


G.fast A1 vs A3 Comparison



G.fast Performance Comparison

G.fast (TP), G.fast (Coax) and Vectoring Performance



Symmetric(-like) Service Offerings



Dynamic Time Allocation

- iDTA available for Coax and Single-pair Copper
- cDTA prototype for Multi-pair Copper



Thank you for using the Adtran Speed Test Server.



Restart Test

Latency



2 ms

Speed

Download Speed

765.84 Mbps

Upload Speed

786.51 Mbps

Profile: Flat PSD 5-106 MHz Coax Mode
DTA_Enable: True
MAXATP : 2 dBm
Lab Test Setup: (loop length 300 ft RG6 coax)

Universal Service Levels?

ADENDUM 1

Gigabit
FTTH

750Mbps
GFAST

750Mbps
GFAST

Gigabit
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Universal Service Levels?

ADENDUM 3

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Gigabit

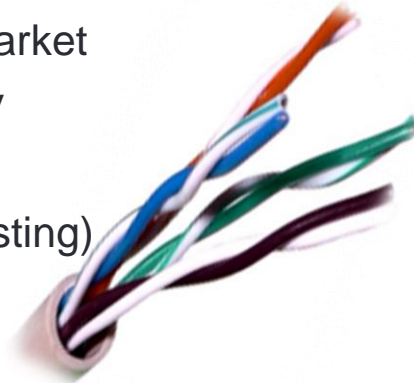
Gigabit
FTTH

Gigabit
FTTH

The choice is yours

Copper

- Pros
 - Reuse – Leverage an existing asset
 - It is already installed (most of the time)
 - Faster time to market
 - End user friendly
- Cons
 - Poor quality (existing)
 - Short Range
 - LOW speeds



Fiber

- Pros
 - Future proof
 - Long Range
 - Very High speeds
 - Consistent
- Cons
 - Difficult to install
 - Telecom is still adapting to it
 - Not End User Friendly
 - Tools, Tools, Tools



Thank you

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